3.5 TEST PROCEDURES

a. General

(1) Scale Installation Requirements

Scale installations shall conform to the requirements in this chapter. Once a scale installation has been approved and has been tested for RFI, motion detection, and associated/nonassociated equipment interference, the scale may be tested for accuracy performance.

(2) Error and Tolerance Scale Accuracy Tests

Scale accuracy tests should be conducted according to the error testing method outlined in this section. The error testing method uses error (balance) weights to provide for error determination to two-tenths of a scale division. This method shall be used for the initial testing of new or modified installations. A second testing method, tolerance testing, may be used on electronic scales if circumstances, such as wind, make it impractical to use the error testing method.

(3) "As Found" Testing Requirements

Each scale shall be tested without adjustment to determine the "as found" condition and the results recorded on the test report. A printed weight record shall be made at each test load and compared with the scale indication. This printed record shall be attached to and filed with the original of the "Scale Test Report." (See section 3.1, d., (5), (d))

b. Pretest Examinations

(1) Purpose

This examination allows the authorized official to determine whether or not the design and construction of the scale conforms to the specifications and requirements of FGIS.

(2) Pretest Examination Steps

The following steps should be completed prior to performing a scale test.

(a) Determine whether the scale meets all the requirements as addressed in this chapter.

(b) Review the scale log and the previous test reports to familiarize yourself with the scale's history. Check the scale serial and seal numbers.

(c) Observe the scale indicator (beam movement or electronic display) for any obvious abnormalities.

(d) Perform any built-in checks; such as, span reference display, printer check, and display check.

(e) Inspect the load-receiving elements for potential problems; e.g., worn bearing, cracked load cell cable, check rod binds, dirty conditions, or inadequate clearance around scale parts.

(f) Check the test standards to ensure that they are currently certified and that the lifting apparatus will not interfere with the scale balance when the test weights are in the down position.

c. Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI) Test

This test is required for new or modified installations or whenever the scale official deems it necessary. This field test procedure applies to all electronic scales including analog and digital types. The test will determine whether or not the electronic scale equipment will perform satisfactorily while in the presence of EMI/RFI signals. EMI and RFI may originate from sources such as mobile communications equipment, commercial AM, FM, and TV broadcast transmitters. The result of such interference may cause weight indications to display inaccurately, printer devices to print erroneous information, and data transmission or processing equipment to malfunction.

(1) Test Distances

At a distance not nearer than 1 meter to the equipment under test, and with the scale in a no-load condition and at any test load, operate the following equipment by alternately activating and deactivating the transmitter key under the specified conditions.

Table 14 Conditions for Testing RFI

Frequency	Field Strength	Modulation
26-MHZ 5-watt hand held communicator	Not to exceed 3 V/m	50% Amplitude, 1 kHz Sinewave
460-MHZ 4-watt hand-held	Not to exceed 3 V/m	50% Amplitude, 1 kHz Sinewave

(2) Allowed Variation

The variation of the weight indication with the disturbance compared with the weight indication without the disturbance shall not exceed one scale division (d) or the equipment shall:

(a) Blank the indication;

(b) Provide an error message; or,

(c) The indication shall be so completely unstable that it could not be interpreted, or transmitted into memory or to a recording element, as a correct measurement value. (H-44, 1994, T.N.9. in part)

d. Associated, Nonassociated Equipment Test

A weighing device shall meet all performance requirements when associated or nonassociated equipment is operated in its usual and customary manner and location. This test is required for new or modified installations or whenever the scale official deems it necessary. (H-44, 1994, G-UR.3.2 in part)

(1) Strain Test

During the test of the scale, apply a load equivalent to the normal weight applied to the scale and allow the scale to stabilize.

(2) EMI Test

Operate each electrical device, one at a time, if possible, in the vicinity of the scale and evaluate the scale performance. The following is a list of common devices that should be evaluated: lighting systems, office equipment, appliances, vending machines, stock handling equipment, elevators, hoists, relay switching equipment, motors, industrial controls, generators, brush type motors, electric tools, communications equipment, elevating legs, and belt conveyors.

(3) Source Interference Verification

If performance of the scale appears to be affected by any of the devices, the suspected interfering device should be turned on and off to verify it as the source of the problem. Note all findings on the test report.

(4) Scale Approval

Scales that fail to perform to the requirements of this section shall be rejected.

e. Motion Detection Test

(1) General

This test is required for new or modified installations or whenever the scale official deems it necessary. Electronic scales shall have motion detection capability which restricts printing of a weight value whenever the displayed weight is not stable within ± 1 division.

NOTE: The motion detection test shall be performed whenever a floating rig hopper scale is tested.

(2) Testing Procedures

(a) Place the scale in manual mode.

(b) Apply a test load, or in the case of hopper scales, fill the scale with an amount of grain equal to a normal draft amount.

(c) Allow the scale to stabilize.

(d) Physically move the load receiving element to produce approximately a 10 division weight fluctuation while the print button is depressed.

(e) Stop moving the load receiving element and keep the print button depressed until a weight is printed.

(f) The printed weight must be within ± 1 division from the original weight.

(g) Keeping the load on the scale, repeat several times starting with step (3).

f. Printer Tests

(1) General

Weight recording device(s) for electronic scales shall be tested, whenever deemed necessary, for accuracy in converting the displayed weight to a printed weight.

(2) Scales With a Built-in Printer Test

If the scale incorporates a built-in printer check, observe it in operation.

(3) Test Procedures for Scales Not Having a Built-in Printer Test

(a) Use zero adjustment to display and print all digits 0-9 in the tens, hundreds, and thousands columns as high as the adjustment will allow.

(b) In many electronic scales the zero adjustment only reaches to 2 or 3,000 pounds, after which the rest of the digits within the thousands, ten thousands, and hundred thousands pound columns can be displayed by filling the hopper with grain. This can be accomplished during the buildup test, or in the case of vehicle or track scales, several different test loads can be used to check the printer in higher ranges.

g. Sensitivity Tests

(1) General

A sensitivity test shall be conducted on nonautomatic-indicating scales only. The test shall be conducted with the weighing device in equilibrium at zero-load and at maximum test load by increasing or decreasing the test load in an amount equal to the applicable value indicated below. If the device is tested with a balance indicator, it shall only be operated with a balance indicator. If the device is tested without a balance indicator, it shall be operated without a balance indicator. (H-44, 1994, N.1.4., T.N.6., in part)

(2) Test Load Requirements

(a) The test load for sensitivity for nonautomatic-indicating vehicle scales shall be 1d equipped with balance indicators, and 2d or 0.2 percent of the scale capacity, whichever is less, for scales not equipped with balance indicators.

(b) For all nonautomatic-indicating scales, the test load for sensitivity shall be 1d at zero and 2d at maximum test load.

(c) The sensitivity requirement (SR) for all other scales is listed in the tolerance section of this chapter.

(3) Test Procedures

(a) Add to or remove from the load-receiving element error/balance weights in intervals equal to 0.2 the minimum division.

(b) Sensitivity is determined by the amount of weight needed to bring the weighbeam from a condition of equilibrium in the center of the trig loop to a stable condition at the bottom or top of the trig loop,

whichever the case may be. Record the actual sensitivity in pounds on the "Scale Test Report."

h. Discrimination Test for Electronic Scales

(1) General

A discrimination test shall be conducted on digital automatic-indicating scales with the weighing device in equilibrium at zero-load and at maximum test load and under controlled conditions in which environmental factors are reduced to the extent that they will not affect the results obtained. Electronic grain test scales require this test only during National Type Evaluation Program approval. (H-44, 1994, N.1.5., T.N.7. in part)

(2) Test Procedure

Conduct this test from just below the lower edge of the zone of uncertainty for increasing-load tests, or from just above the upper edge of the zone of uncertainty for decreasing-load tests. Set the digital indication at the lower edge or just above the edge of the zone of uncertainty as follows. (H-44, 1994, N.1.5.1.)

(a) Set the digital indication to a stable indication using the tare adjustment or error/balance weights.

(b) Add error/balance weights in increments of 0.1d to the load-receiving element until the weight indication flashes to the next higher division.

(c) Remove 1d and the weight indication should be stable at the lower value. This is the leading edge of the zone of uncertainty.

(d) The indication can be set to just above the zone of uncertainty by adding error/balance weights until the flashing stops and the weight indication is stable at the next higher division. This point is established for use in decreasing-load tests.

(e) Add the equivalent of 1.4d to the load-receiving element. The weight indication shall change at least 2d from the starting value. (H-44, 1994, T.N.7.2. in part)

i. Weighbeam Test

(1) Fractional Poise Test Using Known Test Weights

This test should be performed when sufficient test standards are available to apply to the load-receiving element.

(a) Balance the beam at zero with error/balance weights equal to the minimum division applied to the load-receiving element.

(b) Apply test weights equal to approximately one-half and full capacity of the fractional poise to the load-receiving element.

(c) Move the fractional poise to the graduation equal to the test load applied and observe the beam for balance.

(d) To determine error, add or subtract error/balance weights until the beam balances, and record results on "Scale Test Report."

(e) The fractional poise indication must be within the applicable tolerance (minimum tolerance). Proper seating of the poise on the beam is a critical factor for the accuracy of beam operation.

(2) Fractional Poise Test Utilizing Butt Ratio Weight Kits (Optional)

This test eliminates indications of error that may be present in the lever system and uses the known weighbeam butt ratio.

(a) Balance the beam with the poise at zero and with a hanger pan connected to the beam rod or beam rod containing butt ratio weights equal to at least the minimum division.

(b) Determine the weighbeam nominal butt ratio by placing l pound on the beam rod hanger pan and bringing the beam to balance by moving the poise. The poise indication is the butt ratio.

(c) Apply butt ratio weights proportional to one-half and full capacity of the fractional poise (using the beam ratio).

(d) Determine equivalent error in poise by noting the discrepancy in poise indication and calculated indication.

(e) The fractional poise must be within applicable tolerance (minimum tolerance). Proper seating of the poise on the beam is a critical factor for the accuracy of beam operation.

(3) Ratio Test for Scales with CP Beams (Counter-poise Weighbeams)

A ratio test shall be conducted on scales employing counterpoise weights. Ratio tests determine if the actual system ratio between counterpoise weights and applied load meets specific tolerances with respect to the standard ratio for the weighing device (usually 1,000 to 1). (H-44, 1994, N.1.7. in part)

NOTE: The facility's counterpoise weights shall not be used in this test. As these counterpoise weights are required to conform to their own standards, any error in these weights would detract from the purpose of the ratio test. Standard slotted weights from the test weight kits shall be used to counterbalance the known test load applied. To adequately perform this test, a sufficient known test load (10% of scale capacity) must be available.

(a) Determine weighbeam tip ratio (e.g., 1,000 to 1).

(b) Apply error/balance weights to the load-receiving element equal to the tolerance of the known test load.

(c) Balance the beam with the poise set at zero and with no weight on the counterpoise stem.

(d) By using the ratio of the system, apply ratio weights to the counterpoise tip hanger equivalent to the applied load on the weigh hopper.

(e) Determine the actual error -- the amount of error/balance weights needed to be subtracted from or added to the load-receiving element to bring the beam to a balance condition.

j. Hopper Scale Buildup Test

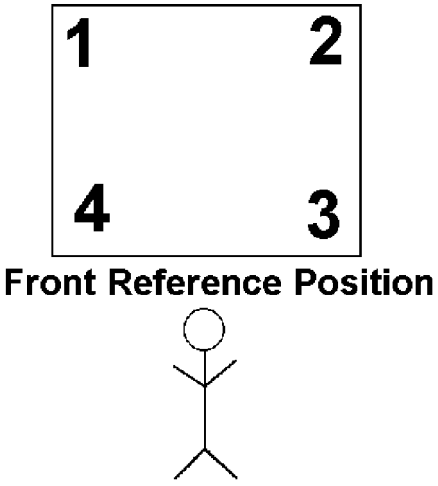
A buildup test using bulk material shall be conducted in increments not to exceed the total value of the official test weights; the test shall be conducted to the certified capacity of the weighing system. The applicable tolerance shall apply to the known test load at each step. (H-44, 1985, N.1.1. ABWS Code in part)

(1) Corner Test

A corner test shall be performed whenever possible before the buildup test begins. This test helps to indicate that no errors or binds exist in any of the levers or that load cell output is approximately the same from each load cell. The indication of each corner must be within ± 1 division.

(a) Balance the scale at zero load.

(b) Lift one-quarter of total test weight(s) (one corner).



(c) Record indicated or displayed weight value, repeat for each corner. Number the corners as indicated above.

(2) Mechanical Hopper Scales Test

(a) Apply error/balance weights to the load-receiving element equal to at least the applicable tolerance (usually one scale division.)

(b) Balance the scale (weigh hopper empty) at zero.

(c) Apply the known test load to the weigh hopper (at least 12.5% of scale capacity).

(d) Move poise to appropriate position on beam (position equal to the applied load).

(e) Determine error by the amount of error/balance weights added to or subtracted from the load-receiving element needed to bring the beam to balance.

(f) Record the test weight applied and error (print ticket).

(g) Remove test weights and record any zero balance change. (Balance should return to within the minimum applicable tolerance.)

(h) Add grain to weigh hopper not exceeding the amount of the test weight that had been previously applied and determine a balance reference point (using error/balance weight if needed).

(i) Add test weights, add or remove error/balance weights to balance beam and record error (print ticket). Continue the buildup test to the scale capacity.

(j) Upon the completion of the buildup test, the test weights should be removed from the device and the grain dumped from the hopper. All original error/balance weights shall be returned to the load-receiving element.

(k) Zero balance change shall be recorded after all grain and test weights are removed from the scale and can be determined by adding or removing error/balance weights. Zero balance shall not change more than the applicable tolerance. If zero balance change is out of tolerance, empty the scale, reload the scale with grain, empty and check the balance change again.

(l) The weighbeam shall be returned to a zero balance condition before being put into official weighing operation.

(3) Levertronic or Full Electronic Hopper Scale Test

(a) Error Test Method

This procedure shall be used for initial tests on new installations or whenever the scale official deems it necessary. To minimize misinterpretation of displayed weight representations and to increase the accuracy of test data, the test shall be conducted from the leading edge of the zone of uncertainty.

1) Apply error/balance weights to the load-receiving element equal in amount to the minimum division.

2) Apply error/balance weights in intervals equal to 0.2 the minimum division to the load-receiving element until the indicator just begins to flash between the zero-balance weight and the next division. Record on Scale Test Report the total amount of pounds of error/balance weights on the load-receiving element.

3) Apply the known test weights to the load-receiving element and observe the indicated weight.

4) Add to or subtract from the load-receiving element error/balance weights until the indicator displays the appropriate weight. (Example: zero reference 0/10 when 10,000 pounds applied, indicator should read 10,000/10,010.) Record the total amount of error weights on the load-receiving element.

5) Error shall be determined by the amount of error/balance weights added to or subtracted from the load- receiving

element to achieve the desired or correct reading. Record error.

6) Remove test weights. Return original amount error/balance weights and record zero balance.

7) Continue alternately filling with grain and applying test load until scale is tested to capacity.

8) Remove test weights and empty the hopper. Check and record zero balance with respect to original error/balance weights.

9) The applicable tolerance shall apply only to the known test load at each step.

(b) Tolerance Test Method

The buildup test on electronic/levertronic hopper scales shall involve the substitution of material (grain) for known test weights.

1) Record the no load indication in the grain column of the "Scale Test Report."

2) Apply test weights and observe indication. Record on the Scale Test Report both test weights applied and indication under the test weight column and scale indication column respectively.

3) When recording weight indications during a tolerance test, the indication may be at the breakpoint between two indications, which frequently causes the indication to change by 1 division. If this is the case, record both weight indications; e.g., 10,000/10 under the appropriate column.

4) Determine error by the difference between actual indication and the computed correct indication. Record error underthe error column on the "Scale Test Report." Error derived

from a changing weight indication shall be recorded as one-half a division.

5) At each step the error shall not exceed the applicable tolerance applied to the known test weights and the accumulated error shall not exceed the applicable tolerance applied to the total load (grain + test weights).

6) The accumulated error shall be determined by the addition (algebraic sum) of individual step errors. Add to the tolerance would otherwise apply (individual lifts and accumulated load) an amount equal to one-half the minimum value that can be indicated or recorded.

7) Remove test weights, record zero balance, and add grain to the hopper not exceeding the previous test point. Record indication under the grain column on the "Scale Test Report."

8) Apply test weights. Observe indication and determine error. Record test weights applied, indication, and error in the appropriate Scale Test Report columns. Check accumulated error, if any.

9) Continue alternately filling with grain and applying test weights until the scale is tested to capacity.

10) When scale is tested to capacity, discharge grain, remove test weights, check zero balance, and record on the bottom right-hand corner of the "Scale Test Report."

k. Associated Tests for Hopper Scales

(1) Associated Test for Venting

The effects of air pressure or vacuum on a scale can create erroneous weight representations on the indicating element. The following checks are examples of the type testing that should be used to evaluate venting. Special situations may dictate additional evaluation on the part of the scale official.

(a) Testing Under Static or Dynamic Conditions

1) Bring the indicating element to an exact balance condition.

2) With the upper garner empty, open the upper garner gate and observe any change in the balance indication.

3) With the upper garner empty, open the weigh hopper gate and observe any change in the balance condition. Repeat with the upper garner full.

4) Repeat step (3) with turn heads and spouting located in various positions to simulate normal operation.

5) Indication changes of ± 1 division are acceptable. Larger variations should be investigated and the cause documented on the "Scale Test Report."

(b) Testing While Weighing Grain

Make the following checks and observations during normal weighing operations.

1) Check for agreement between displayed and recorded weight value. As soon as the weight is printed and prior to the opening of the weigh hopper gates, press the "stop" or "hold" button or function that will stop the automatic cycle. The printed weight should then be compared to the displayed weight.

2) Check for agreement within ± 1 division between the displayed weight and recorded weight value at the time the tare weight is printed.

3) Observe tare weights printed during a series of drafts. Tare weights should be within plus or minus 1 division of each other. However, a slow change in recorded tare weight is

acceptable if it is caused by buildup of grain on the scale or by long-term drift due to temperature changes.

(2) The Effects of Hysteresis and Creep Encountered During Testing Of Electronic/Levertronic Scales

Hysteresis and creep, if encountered during testing of grain hopper scales, shall be recorded on the "Scale Test Report."

(3) Time Dependence Requirements for Scales Manufactured After January 1, 1987

At constant test conditions, the indication 20 seconds after the application of a load and the indication after 1 hour shall not differ by more than the absolute value of the applicable tolerance for the applied load. (H-44, 1994, T.4. ABWS Code)

(4) Determination of Allowable Time for Retention of Grain in a Weigh Hopper, For Scales Installed Prior to January 1, 1987

Except for emergencies, trimming a load, and cleaning out of a carrier, grain shall not be retained in the scale hopper beyond the normal operating cycle time. An operational time limit for the length of time a scale can remain under load can be determined by the scale official using the following method.

(a) Establish the time limit for performing this test, which is the maximum amount of time that grain would be retained in the hopper (example: 2 hours).

(b) Carefully set zero balance to ensure a good starting reference point.

(c) Fill the scale to the normal operating weight range and record the indicated weight.

(d) Record the indicated weight value every ½ hour until total time limit is reached (example: ½ hour, 1 hour, 1 ½ hours, 2 hours, etc.).

(e) Discharge all grain and make sure the scale is empty.

(f) Record empty weight of the scale.

(g) If the total amount of weight change between the first and last recorded weights of the full scale does not exceed the allowable error at that weight (1 pound per thousand) and the scale returns to zero balance within plus or minus 1 division, the scale is approved to hold a load for up to the tested time limit (in this example: 2 hours).

NOTE: During operation it is important that the gross weight be printed immediately after filling for the most accurate weight.

(5) Floating Rig List Test

The list test shall be performed as a part of new or modified installation certification requirements for floating rigs.

(a) Ensure that an inclinometer readable in at least ½ degree intervals is mounted perpendicular to the longitudinal axis of the boat, ship, or barge and within easy reading distance of the weight indicating element. The use of this instrument in testing the scale sets parameters for the maximum degree of list allowed during official weight certification.

(b) Utilizing the inclinometer the rig shall be brought to a zero list and a buildup test to scale capacity performed.

(c) The weigh hopper shall be filled to a normal draft size.

(d) The rig operator shall list the rig to ½ degree by whatever means available. When ½ degree list is reached, the reference weight shall be observed.

(e) This sequence shall continue at ½ degree intervals until the observed reference weight changes more than the applicable tolerance applied to that load and the rig cannot list any further.

(f) The maximum degree of list determined during the performance of this test will set the parameters allowable during official weighing; i.e., if the scale is found to be outside the allowable tolerance limits at 2 ½° list, no official weight shall be allowed when the scale exceeds 2° list.

(6) Floating Rig Dynamic Test

To simulate actual loading conditions and the effect of motion on the accuracy of the scale system, a dynamic test shall be conducted. The test shall be performed as part of the initial new or modified installation approval procedure.

(a) Fill the scale to a normal draft size. Approximately three-quarters of scale capacity.

(b) Record the digital indication. This is the reference weight.

(c) Calculate the number of prints to be recorded by dividing 50,000 bushels (or 2,800,000 pounds in the case of corn) by the reference weight and multiplying by 2.

(d) Determine print cycle time by dividing the normal draft cycle time by two. Normal draft cycle time is the time it takes the scale in normal operation to fill, print gross, discharge, and print tare.

(e) The print cycle time shall be the time between the previous printed weight data and the initiation of the next print cycle (i.e., depressing a print button). Due to effects of motion and settling time, there is a lapse between the actual initiation of a print cycle and the recording of the displayed weight.

(f) Cover the weight display to prevent biased test results.

(g) The rig operator shall begin simulating motion by using appropriate unloading mechanisms. If the rig is equipped with cranes, they will be required to swing a load approaching normal loading operations. This can be simulated by using the crane which will "scoop" water from the river, bay, etc. Discharge the water with the crane boom positioned at either end (bow or stern) of the rig.

(h) Initiate first print and wait until a weight is recorded.

(i) Pause for print cycle time and then initiate next print.

(j) Continue this print time sequence until the predetermined number of prints has been recorded. (Observe tapes for inaccurate weight representations.)

(k) Total the tape.

(l) Since interlocking mechanisms only allow a plus or minus printing sequence, totaling the tape at the end of the test will provide a total which represents an algebraic summation of all the weight deviations caused by rig motion. (The application of this test will ensure that mechanical favoritism towards either over or underregistration is not occurring.)

(m) The total amount of error (tape total) incurred during dynamic testing shall not exceed 0.1 percent of the total simulated load. This is determined by multiplying the static reference load by the number of "drafts" simulated. For example: Reference load prior to dynamic testing on a 5-pound division scale is 15,000 pounds. To simulate 2,800,000 pounds, 187 drafts are needed.

187 x 15,000 = 2,805,000 x .1% = 2,805 pounds

Scale error shall not exceed 2,805 pounds.

l. Vehicle Scale Test

The following outlines are excerpted from NCWM Publication 12, Examination Procedure Nos. 13, and 13 E dated, December 1991. Follow these outlines when testing vehicle scales: Use the outline following item (1) for scales equipped with weighbeams and/or mechanical dials; use the outline following item (2) when the scales are equipped with electronic digital indicators.

SAFETY NOTES

The inspector is reminded of the importance of evaluating potential safety hazards prior to an inspection and taking adequate precautions to avoid personal injury or damage to the device. The inspector should read and be familiar with the introductory section of Section 3.7 of this Chapter. As a minimum, the following safety precautions should be noted and followed during the inspection. Definitions of each reminder are found in the "Glossary of Safety Key Phrases" in Section 3.7.

Many policies and regulations will vary from jurisdiction to jurisdiction. It is essential that the inspector or serviceperson be aware of all safety regulations and policies in place at the inspection site and practice the safety policies established by the inspector's or serviceperson's employer. The safety reminders included in this EPO contain general guidelines for safety. These guidelines are useful in alerting inspectors and servicepersons to the importance of taking adequate precautions to avoid personal injuries. These guidelines can only be effective in mitigating safety hazards if inspectors and servicepersons receive training in hazard recognition and controls.

- Clothing
- First Aid Kit
- Lifting
- Electrical Hazards
- Support -- for scale, test weights, and test equipment
- Safety Cones/Warning Signs
- Transportation of Equipment
- Location

  also: Wet/Slick Conditions
  Chemicals, Petroleum Products, and Hazardous Materials
  Overhead Hazards
  Obstructions
- Personal Protection Equipment

  e.g. Safety Shoes
  Hard Hat -- for protection from overhead hazards

INSPECTION

Safety First !!!

Check the inspection site carefully for safety hazards and take appropriate precautions

Learn the nature of hazardous products used at or near the inspection site

Use caution in moving in wet, slippery areas

Use personal protection equipment appropriate for the inspection site

Position safety cones and warning signs if necessary

Be sure a first aid kit is available and that the kit is appropriate for the type of inspection activity

(1) Weighbeams and Dial Vehicle Scales

Examination Procedure Outline for Vehicle Scales Mechanical - Analog Indicating (Weighbeams and Dials)

Follow this outline for vehicle scales equipped with weighbeams and/or mechanical dials. Requirements that apply only to scales marked with an accuracy class are indicated with an asterisk. Nonretroactive requirements are followed by the applicable date in parentheses.

	H-44 General Code and Scales Code References
1. Zero-load balance as found. If the device is not in balance, the user should be made aware of paragraph UR.4.1.and a warning issued if necessary.	S.1.1., S.2.1.1., S.2.1.2., S.1.5.1., UR.4.1.
2. Marking	
Indicating and recording elements	G-S.1., G-S.6. (1/1/77), G-S.7.,G-UR.2.1.1., S.6.1. (1/1/89), S.6.3.
Weighing and load-receiving elements	S.6.1. (1/1/89), S.6.2., S.6.3.
3. Indicating and recording elements.	
Scale division, value (d) and number (n)	S.1.2.*, S.5.*, UR.1., UR.1.1.(b)
Tare division value	S.2.3. (1/1/83)
Tare mechanism	S.2.3.

Appropriateness of design	
General	1G-S.5.
Weighbeams	S.1.5. except S.1.5.5.
Poises	S.1.6.
Dials and balance indicators	S.1.3., S.1.4., S.1.7.
Damping means	S.2.5.
Suitability	S.5.2. (1/1/86)*, UR.1.1.(a)*, UR.3.1.*, UR.3.2., UR.3.3.
Customer readability, if applicable	G-UR.3.3.
Adjustable components	S.1.10.
4. Weighing and load-receiving elements	S.4., UR.2.8.
Access	UR.2.5.
5. Installation	G-UR.2., UR.2.3., UR.2.4.

Check to be sure the scale supports are adequate to support the scale, test equipment, <u>and</u> test weights equal to the capacity of the scale!

6. Approaches	
Vehicle scales	UR.2.6.1. (1/1/76)
Axle-load scales	UR.2.6.2.
7. Maintenance, use, and environmental factors	G-S.2., G-UR.1.2., G-UR.3.1., G-UR.4.,UR.3.2., UR.3.3., UR.3.7., UR.3.8., UR.4.3.
8. Assistance	G-UR.4.4.

Pretest Determinations:

1. Tolerances	
Acceptance/maintenance	G-T.1., G-T.2.
Application	T.N.2.1., T.N.2.3.

Tolerances values:

Scales marked with an accuracy class	T.N.3.1./Table 6 (Class III L),T.N.3.2., T.N.4. (except T.N.4.5.), T.N.5.
Scales not marked with an accuracy class	T.1.1., T.N.3.1./Table 6 (Class III L), T.N.3.2., T.N.4. (except T.N.4.5.), T.N.5.
Discrimination	T.N.7.1.*

Sensitivity:

Scales marked . .	T.N.6.1.(a), T.N.6.2.
Scales not marked	T.2.1., T.2.7.

2. Determine maximum test load to be applied during test: a test load not to exceed marked concentrated load capacity (or for scales manufactured prior to January 1, 1989, the marked Section Capacity) may be applied to any section or between any two sections. A test load of 100 percent of capacity may be distributed over the entire platform.

3. Minimum test weights and test loads — N.3.

Carefully inspect electrical supply lines for test equipment for wear or damage; correct potentially hazardous conditions before use; protect lines from damage during use.

Test notes:

Wear appropriate personal protection equipment such as safety shoes to prevent possible injury from falling weights and slipping on slick surfaces and a hard hat to prevent injury from overhead hazards

1. If beam scale, balance small error weights on the platform, the smallest weight equal to the minimum tolerance value and the total value of the weights being equal to the tolerance value at maximum test load.

2. Check repeatability of, and agreement between, indications throughout the test — T.N.5., G-S.5.2.2.(b)

3. Recheck zero-load balance each time test load is removed — N.1.9., G-UR.4.2.

4. If the scale is equipped with a type-registering (T.R.) beam or a printer, print ticket at each test load. — G-S.5.6., UR.1.3.(1/1/86)*, G-S.5.2.2.(b)

Test:

Wear Safety Shoes! Use Proper Lifting Techniques

1. Sensitivity test at zero load (for weighbeams and balance indicators only) — N.1.4.

Discrimination (dials and balance indicators with graduations having a specific value only) — N.1.5. (1/1/86)*

2. Increasing-load and shift (section) test — N.1.1.

a. If beam scale, test at not less than two points on each weighbeam. Scales not equipped with a full capacity beam should be ratio tested using standard weights on counterpoise hanger. At each test load, test scale counterpoise weights by substituting them for the standard counter poise weights. If there is any noticeable change in the indication, remove the counterpoise weights from service until it can be determined it meets the requirements in the Weights Codes of H-44. When ratio testing, test poise and beam by substituting poise position with the removal of standard weights from counterpoise hanger. N.1.7.

b. If automatic-indicating scale, test at not less than three points on reading face, including all possible quarters of the reading-face capacity. Test all unit weights possible.

c. When performing a shift test, use not less than two different loads successively distributed any where on the load-receiving element using the prescribed test patterns and maximum test loads specified below. N.1.3.4.

Test pattern: An area at least 4 feet long and a width equal to the width of the scale platform. When loading the scale for testing, one side of the test pattern shall be loaded to no more than one quarter of the concentrated load capacity before loading the other side.

Multiple pattern loading: To test to the nominal capacity, multiple patterns may be simultaneously loaded in a manner consistent with the method of use.

Other designs: Special design scales and those that are wider than 12 feet shall be tested in a manner consistent with the method of use, but following the principles described above.

Test load: The maximum test load applied to the prescribed test pattern shall not exceed the concentrated load capacity (or for scales manufactured prior to January 1, 1989, the rated section capacity).

Note: When testing scales manufactured prior to January 1, 1989, caution should be exercised when loading test weights equivalent to the rated section capacity onto areas between sections.

Note: When loading the first section to be tested, it is recommended observations be made at each increment of test weight application.

3. Decreasing-load test (dials only), at one-half of maximum test load (at no less than one-half dial face capacity)	N.1.2., N.1.2.2.
4. Strain-load test on at least two sections apply tolerance to test weight load only.	N.1.1.
5. Sensitivity test at maximum test load (weighbeams and balance indicators only)	N.1.4.
Discrimination (dials and balance indicators with graduations having a specific value only)	N.1.5. (1/1/86)*
6. Counterpoise-weight test, if device is so equipped	H-44 Weights Code
7. Remove test load and determine any zero-load balance change	N.1.9., G-UR.4.2.

8. Remove error weights and establish correct zero-load balance.

(2) Electronic Vehicle Scales

Examination Procedure Outline for Vehicle Scales Equipped with Electronic Digital Indicators

	H-44 General Code and Scales Code References
Inspection:	
1. Zero-load balance as found. If the device is not in balance, the user should he made aware of paragraph UR.4.1. and a warning issued if necessary	G-S.5.2.2.(d) (1/1/86)*, S.1.1., S.2.1.1., S.2.1.2., UR.4.1.
2. Marking	
Indicating element:	G-S.1., S.6.3.
Manufacturer's name or ID	Retroactive
Model designation	Retroactive
Serial number	(1/1/68)
Serial number prefaced by term "Serial Number" or "S/N"	(1/1/86)
Accuracy class (may he marked with dual accuracy classes (e.g.,III/III L)	(1/1/88)
Nominal capacity	Retroactive
Shall not exceed the Concentrated Load Capacity (CLC) times the quantity of the number of sections in the scale minus 0.5	S.6.1. (1/1/89)

Value of the scale division shall he marked along with the nominal capacity	(1/1/83)
Temperature limits if other than -10 to 40^0C (14 to 104^0F)	(1/1/86)
Concentrated Load (or Section) Capacity	(1/1/89)
Maximum number of scale divisions (n_{max}) for which the scale has been approved	(1/1/88)
Other	G-S.6. (1/1/77), G-S.7., G-UR.2.1.1.
Weighing/load-receiving elements:	S.6.2., S.6.3.
Markings must he added to load-receiving element at the time of modification to any scale not previously marked	(1/1/89)
Manufacturer's name or ID	Retroactive
Model designation	Retroactive
Serial number	(1/1/68)
Serial number prefix	(1/1/86)
Accuracy class	(1/1/86)
Nominal capacity	Retroactive
Concentrated Load Capacity (CLC) (or Section Capacity for scales manufactured prior to 1989)	(1/1/89)
Minimum verification scale division for which device complies with the requirements (e_{min} or d)	(1/1/89)
Load cells with NTEP Certificates of Conformance	S.6.3.

Note: Required information may he on the data plate attached to load cell OR may be in an accompanying document; except that, if an accompanying document is provided, the serial number shall appear both on the load cell and in the document (1/1/88). Manufacturer's name or trademark, model designation, and serial number prefix shall also he marked both on load cell and in any accompanying document (1/1/91).	(1/1/88)
Accuracy class	
Maximum number of divisions (in units of 1,000) for which accuracy class requirements are met	(1/1/88)
"S"' or "M" for single or multiple cell applications in conjunction with n_{max} for each accuracy class and application	(1/1/88)
Direction of loading if not obvious	(1/1/88)
Temperature limits if other than -10 to 40^0C (14 to 104^0F)	(1/1/88)
Name and address of manufacturer, model designation, minimum dead load, maximum capacity, safe load limit, and load cell verification interval, v_{min}	(1/1/88)
Other equipment	S.6.3.

3. Determination of Load Cell Suitability (applicable to load cells with an NTEP Certificate of Conformance):

a. The number of scale divisions (n) of the scale is less than or equal to the n_{max} of the indicator or the load cells, whichever is less; e.g., if the indicator has an n_{max} of 10,000 and the load cells have an n_{max} of 5,000, then the scale may use up to 5,000 divisions.

b. The load cell is approved for the required accuracy class. **Note**: A Class III load cell may be used in a Class III L application; however, the opposite is not true.

c. The load cell is rated Single (S) or Multiple (M) use as appropriate to the application.

Note: A load cell rated for single use may be used in a single or multiple load cell application; however, a load cell rated for multiple usecannot he used in a single load cell application.

d. The load cell complies with the requirements for temperature effect on zero-load balance

Note: Testing to determine the effect of temperature on zero-load balance cannot he performed in the field; however, for purposes of field inspection, a load cell is considered to comply with T.N.8.1.3. if the v_{min} value marked on the load cell is less than or equal to the v_{min} value as calculated below based upon the d and N for the scale; if it is not, the scale does not comply with T.N.8.1.3.(See also 1988 OWM paper on "Device Regulation Under the New Scales Code.")

T.N.8.1.3., and the table at the end of this seciton, titled, “Maximum Values of Multiple Load Cell Scales”

Full electronic scale with more than one load cell: The verification scale division, v_{min}, for the load cells must he less than or equal to the scale division, d, divided by the square root of the number of load cells, N, used in the scale:

$$v_{min} \leq \frac{d}{\sqrt{n}}$$

Note: Maximum values of v_{min} for commonly encountered multiple load cell scales are listed in the Appendix to EPO 13-E.

For mechanical lever systems with a single load cell:

$$v_{min} \leq \frac{d}{\text{scale multiple}}$$

4. Indicating and recording elements. Scale division, value (d) and number (n)	S.1.2.*, S.1.2.1. (1/1/89), S.5.*, UR.1.,UR.1.1.(b)
Rounding	G-S.5.2.2.(c)
Tare division value	S.2.3. (1/1/83)
Tare mechanism	S.2.3.
Damping means	S.2.5., S.2.5.1.(a)
Appropriateness of design	G-S.5.
Suitability	S.5.2. (1/1/86)*, UR.1.1.(a)*, UR.3.1.*, UR.3.2., UR.3.3.
Customer readability, if applicable	G-UR.3.3.
Adjustable components	S.1.10.
Provision for sealing	S.1.11.(a) (1/1/79),S.1.11. (b) (1/1/90), G-S.8. (1/1/90), G-UR.4.5.
5. Weighing element	S.4., UR.2.8.
Access	UR.2.5.
6. Installation	UR.2.3., UR.2.4., G-UR.2.

Check to be sure the scale supports are adequate to support the scale, test equipment, <u>and</u> test weights equal to the capacity of the scale!

7. Approaches

Vehicle scales	UR.2.6.1. (1/1/76)

8. Maintenance, use, and environmental factors	G-S.2., G-UR.1.2., G-UR.3.4., G-UR.4., UR.3.2., UR.3.3., UR.3.7., UR.3.8., UR.4.3.
9. Assistance	G-UR.4.4.

Pretest Determinations:

1. Tolerances:

Acceptance/maintenance	G-T.1., G-T.2.
Application:	
Scales marked with an accuracy class	T.N.2.1., T.N.2.3.,T.N.2.4.
Tolerance values:	
Scales marked with an accuracy class	T.N.3.1./Table 6 (Accuracy Class III L), T.N.3.2., T.N.4.1., T.N.4.4., T.N.5.
Scales not marked with an accuracy class	T.1.1., T.N.3.1./Table 6 (Class III L),T.N.3.2., T.N.4.1., T.N.4.4., T.N.5.
Discrimination	T.N.7.2.

2. Determine maximum test load to be applied during test:

A test load not to exceed marked concentrated load capacity (or for scales manufactured prior to January 1, 1989, themarked section capacity) may be applied to any section or between any two sections. A test load of 100 percent of capacity may be distributed over the entire platform.

3. .Minimum test weights and test loads — N.3.

(**Note:** Term "recommended' to be deleted 1/1/94.)

Test notes:

Wear appropriate personal protection equipment such as safety shoes to prevent possible injury from falling weights and slipping on slick surfaces and a hard hat to prevent injury from overhead hazards

1. Check repeatability of, and agreement between, indications throughout test — G-S.5.2.2.(a), G-S.5.2.2. (c)

2. Recheck zero-load balance each time test load is removed — N.1.9., G-UR.4.2.

3. If the scale is equipped with a printer, print ticket at each test load. If the device will print only one load without returning to "zero", check printer with at least four different loads at convenient times during test. Check effectiveness of motion detection — G-S.5.6., S-2.5.1.(a), UR.1.3. (1/1/86)*

4. If, during the conduct of the test, the performance of the device is questionable with respect to the zone of uncertainty and the width of zero, tests may be conducted to determine compliance	N.1.5. (1/1/86)*, N.1.5.1., S.1.1.1.
5. If the device is equipped with operational features such as programmable tare, multiple tare memory, weigh-in/weigh-out, or multiple weighing elements,check proper operation and appropriateness	G-UR.4.1., G-UR.4.2., S.4.3.

Test:

Wear Safety Shoes! Use Proper Lifting Techniques!

1. Discrimination test at zero load, if deemed necessary and if environmental conditions can be controlled	N.1.5. (1/1/86)*, N.1.5.1.
2. Increasing-load and shift (section) test	N.1.1., N.1.3.4.

Use at least two different loads successively distributed anywhere on the load-receiving element using the prescribed test patterns and maximum test loads specified below.

Test pattern: An area at least 4 feet long and a width equal to the width of the scale platform. When loading the scale for testing, one side of the test pattern shall be loaded to no more than one-quarter of the concentrated load capacity before loading the other side.

Multiple pattern loading: To test to the nominal capacity, multiple patterns may be simultaneously loaded in a manner consistent with the method of use.

Other designs: Special design scales and those that are wider than 12 feet shall he tested in a manner consistent with the method of use but following the principles described above.

Test load: The maximum test load applied to the prescribed test pattern shall not exceed the concentrated load capacity (or for scales manufactured prior to January 1, 1989, the rated section capacity).

Note: When testing scales manufactured prior to January 1, 1989, caution should be exercised when loading test weights equivalent to the rated section capacity onto areas between sections.

Note: When loading the first section to be tested, it is recommended that observations be made at each increment of test weight application.

3. RFI/EMI Test (if a problem is suspected). Conduct test with equipment and under conditions that are usual and customary with respect to location and use of the scale

G-N.2., G-UR.3.2., G-UR.4.2.,G-UR.1.2., N.1.6., T.4., T.N.9.*

4. Decreasing-load test, at one-half of maximum test load	N.1.2., N.1.2.2.
5. Strain-load test on at least two sections; apply tolerance to test weight load only	N.1.1.
6. Discrimination test at maximum test load, if deemed necessary and if environmental conditions are controlled	N.1.5. (1/1/86)*, N.1.5.1.
7. Over-capacity test (if practical)	S.1.7.
8. Recheck zero-load balance change	N.1.9., G-UR.4.2.
9. Test for proper design of automatic zero-setting mechanism, if device is so equipped	S.2.1.3.(b) (1/1/81)
10. If equipped with a semi-automatic zero-setting mechanism (push button), test effectiveness of motion detection	S.2.1.2.(a)
11. Check proper design of tare auto-clear, if device is so equipped	S.2.3. (including note for auto-clear 1/1/83)
12. Establish correct zero-load balance.	

Maximum Values of
Multiple Load Cell Scales
(Table values are in pounds.)

Load Cells	Scale Division 1 lb	2 lb	5 lb	10 lb	20 lb	50 lb	100 lb
2	0.71	1.41	3.54	7.07	14.1	35	70
4	0.50.	1.00	2.50	5.00	10.0	25	50
6	0.41	0.82	2.04	4.08	8.2	20.4	41
8	0.35	0.71	1.77	3.54	7.1	17.7	35
10	0.32	0.63	1.58	3.16	6.3	15.8	32
12	0.29	0.58	1.44	2.89	5.8	14.4	29
14	0.27	0.53	1.34	2.67	5.4	13.4	27

Full electronic scales

Example: For a vehicle scale with four sections (eight load cells) and a displayed scale division of 20 lb, the maximum value permitted for each load cell is 7.1 lb. The calculation is shown below. If the value marked on the load cell is less than or equal to the value computed for the v_{min}, then the load cell is considered to comply with T.N.8.1.3.

$$v_{min} \leq \frac{d}{\sqrt{n}} = \frac{20 \text{ lb}}{\sqrt{8}} = \frac{20 \text{ lb}}{2.83} = 7.07 \approx 7.1 \text{ lb}$$

Lever-tronic Scales

Example: Calculate the multiple of the lever system from the ratios marked on the levers. Suppose the multiple for a vehicle scale is 400:1 and that the scale has a scale division of 20 lb. Then the maximum value for the v_{min} of the load cell is 0.05 lb. The calculation is shown below. If the load cell is marked with v_{min} less than or equal to the calculated value, then the load cell is considered to comply with T.N.8.1.3.

$$v_{min} \leq \frac{d}{\text{scale multiple}} = \frac{20 \text{ lb}}{400} = 0.05 \text{ lb}$$

m. Track Scale Test

(1) General

Railway track scales used for official grain weight certification must be tested semiannually. To accomplish these tests, FGIS uses three test cars, each of which consists of a specially fitted boxcar containing at least 100,000 pounds of test standards in 10,000-pound blocks and one calibrated electric truck (5 feet wheel base) to carry and move the block standards. Other test cars may be used for official testing purposes provided the cars have been certified on an approved master scale within the period of 1 year and are at least 30,000 pounds. (H-44, 1994, N.3.1. in part)

(2) Section Test

(a) General

1) The section test on railway track scales shall be performed bidirectionally; that is, from one direction then repeating in the opposite direction.

2) The test involves the placement of a test car on a prescribed test point, recording the weight, and repeating on succeeding sections. The sections of a railway track scale are numbered 1, 2, 3, etc., from left to right when standing at the weighbeam or indicator, and facing the scale.

a) Normal positions of a test car are designated in order from left to right as: 1R, 2L, 2R, 3L, 3R, 4L, etc. The numbers representing the sections and the letters, when affixed, indicates that the body of the car lies to the left or right of the section with one pair of wheels directly over the section.

b) In the case of a two section scale, an additional position is used with the center of the car midway between the sections. This position is designated as "center" (C).

c) Do not position a test car beyond the load bearing points of a box car unloading scale due to the danger of tipping the scale.

3) The indications of each section must be within the applicable tolerance applied to the known test standards.

4) The maximum deviation between indicated values on the test standards applied to individual sections shall not be greater than the absolute value of the maintenance tolerance.

(b) Procedures

1) Balance the beam at the zero poise setting using the balance ball. Set the dial to zero or adjust the digital indicator to a stable zero. If error/balance weights will be used to determine error, balance out weights on the load-receiving element equal to the tolerance allowed for the amount of test standards to be applied.

2) Apply the test standards to section 1.

NOTE: Prior to moving the standards, examine the bolts, connectors, chains, and hooks. Do not use any equipment that shows signs of wear or fatigue.

3) Move the poise to the graduation equivalent to the amount of test weights. If the beam balances, record error as zero. If it does not balance, then add or remove error/balance weights until the beam balances.

4) Record the number of divisions of error/balance weights added or removed. Record the reading on the dial or digital indicator and record the error.

5) Continue testing all sections in one direction. Then remove the test standards and check zero balance.

(3) Strain Test

(a) When only one test car is available, a light car or empty general service type car can be used in combination with the test car for testing the scales to higher weight ranges.

(b) The weight value of the light weight car (empty) should not exceed the weight value of the test standards. The length of the light car has to be considered as there must be room to place both cars on the scale simultaneously.

(c) Move the light car onto the weigh rails and record indication.

(d) Move the test car onto the weigh rails with the light car and record the indication. Utilize error/balance weights to determine error on the weighbeam scale. The applicable tolerance shall only apply to the test car weight value.

(e) Remove both test car and light car and check zero balance and record.

(4) Standard Graduated Test

A standard graduated test is one made when two test cars are available. Positions and placements coincide with the section test listed previously.

(a) Spot one test car (preferably the light car) on one of the predetermined positions and record sectional indications and error.

(b) Spot both test cars on the weigh rails simultaneously, the center lines of the test cars separated by approximately the same distance as would result between the center line of the trucks when weighing a freight car. Record the positions, indications, and scale error.

(5) Decreasing-Load Test

A decreasing-load test shall be conducted on automatic-indicating scales.

n. Platform Scale Test

(1) General

(a) For the purpose of this instruction, "platform scales" are portable, low capacity bench-type scales that are used for checkweighing, Class X weighing or Class Y weighing of sacked grain, rice and other commodities.

(b) Platform scales shall be tested twice a year at approximately a 6-month interval by FGIS or a State Weights and Measures Official.

(c) A complete set of Class F weights is required to perform the platform scale tests. The weight set should contain at least the following weights: 50 lb (2), 10 lb (2), 5 lb, 2 lb (2), 1 lb, .5 lb, .2 lb (2), .1 lb, .05 lb, .02 lb (2), .01 lb, .005 lb, .002 lb (2), and .001 lb.

(d) Conduct the tests in the following order: sensitivity test, shift test, increasing-load test, (and when applicable, decreasing-load test) zero balance shift test, and dial test.

(2) Tolerances

(a) FGIS-Owned, Unmarked[1] Mechanical Scales (Capacity greater than 100 lb), such as the Accuweigh TDX 301. See Tables 11 and 13 of this chapter for scales where n > 5000.

(b) All Other Scales

See the applicable type scale in Section 3.4 of this Chapter.

[1]Unmarked scales are those manufactured prior to January 1, 1986, that are not marked with a National Institute of Standards and Technology, Handbook 44 accuracy class designation; i.e., II, III, or III L.

(3) Sensitivity Test

(a) FGIS-Owned, Unmarked Mechanical Scales (Capacity greater than 100 lb), such as the Accuweigh TDX 301

1) Balance the scale with a zero-load.

2) Place .1 pound test weight on the scale and note the scale's response.

3) If the weighbeam comes to rest at the limiting stop, the scale meets the sensitivity requirement (SR) and is acceptable.

4) Record the results on Form FGIS-965-2, Scale Test Report - Vehicle.

(b) All Other Scales

1) See Section g., of this section for procedures for conducting a sensitivity test.

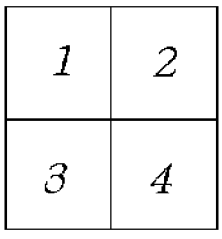
2) See Section 3.4, d., of this Chapter for the sensitivity requirements for all other scales.

(4) Shift Test

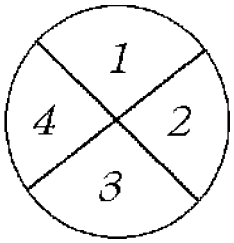
The shift test is used to determine scale accuracy when off-center loads are applied to the platform.

(a) Place a test load equivalent to at least one-half maximum capacity of the scale successively in the center of each quadrant of the load-receiving element. Do not place the test load at the extreme edge of the platform.

(b) The quadrants are numbered as follows:



Square-Type



Round-Type

If the weight indicated by the scale is within the applicable tolerance see Tables 11 and 13 for the test load applied, the scale's shift test response is acceptable.

For example:

Where the tested or certified capacity is 110 pounds on the Accuweigh TDX 301.

$\frac{\text{½ capacity}}{(d)} = \frac{55 \text{ lb}}{.1} = 550d = \pm 2d$ (from table 13) $= \pm .2$ lb tolerance

(c) Record the results on Form FGIS-965-2, Scale Test Report - Vehicle.

(5) Beam-Type Scale Increasing Load Test

This test is used to determine scale accuracy at various loads up to maximum scale capacity.

(a) Balance the scale at zero-load.

(b) Apply the test load to the center of the load receiving element. Test each secondary poise at one-half and full capacity (maximum weight marked on the beam being tested); test the primary poise at one-half and at the maximum-used capacity. Note and record the results on Form FGIS-965-2, Scale Test Report - Vehicle.

(c) If the scale indications are in tolerance (according to Tables 11 and 13 for maintenance tolerances in this Chapter where $n \leq 5000$ d) for all test loads applied, the scale meets the increasing-load requirement.

(d) Upon completion of the increasing-load test, remove the weights from the scale and perform a zero balance shift test (does the scale return to zero). Note and record the results on Form FGIS-965-2, Scale Test Report - Vehicle (see Section 3.1, d. (5) (d))

Example: Platform Scale Tests Performed on an Accuweigh TDX 301.

Step 1. Balance the scale with no load (no weights) on the platform. Place a .1 lb class F test weight on the center of the platform. If the beam comes to rest at the limiting stop, the scale is acceptable (Sensitivity Test).

Step 2. Place a total of 150 lb of class F test weights on center of the upper left hand quarter of the scale platform. If the scale indicates 150 lb, ± .2 lb, the scale is acceptable. Repeat this test on the other three quarters of the scale platform (Shift Test).

Step 3. Determine the capacity and division size of each beam:

Secondary Poise A has a capacity of 2 pounds X .01 pound. (On this scale the .01 lb poise shall not be used officially)

Secondary Poise B has a capacity of 5 pounds X .1 pound.

The Primary Poise has a capacity of 300 pounds X 5 pounds, but in this example the scale is only used to weigh products up to 110 pounds.

Step 4. For each beam, place test weights centered on the scale approximately equal to the beam's half-capacity and full capacity (or up to the used capacity - 110 lb), and record this weight on the test form. Note that we apply a minimum tolerance of ½ d or .05 lb. (Increasing Load Test)

Table 15 Tolerance on Beams for the Accuweigh TDX 301					
Poise	Test Load	Indication	Error	Maintenance Tolerance	Result
A	(Do Not Test)				
B	2.5	2.5	.0	±.1	(In Tolerance)
B	5	5.1	.1	±.1	(In Tolerance)
Primary	50	50.1	.1	±.1	(In Tolerance)
Primary	110	110.3	.3	±.2	(Exceeds Tolerance)

Step 5. Remove the weights from the platform and note the scale response with no load applied (zero balance shift test). In order to be acceptable, the scale should indicate "0", plus or minus 1 d or .1 lb.

(6) Digital Scale Increasing Load Test

(a) Zero the scale at zero-load.

(b) Apply the test load to the center of the load receiving element. Test the scale at one-half and full capacity. Note and record the results on Form FGIS-965-2, Scale Test Report - Vehicle.

(c) If the scale indications are in tolerance [see n. (2)] for all test loads applied, the scale meets the increasing-load requirement.

(d) Upon completion of the increasing-load test, remove the weights from the scale and perform a decreasing-load test and a zero balance shift test (does the scale return to zero). Note and record the results on Form FGIS-965-2, Scale Test Report - Vehicle (attached).

Example: Platform Scale Tests Performed on an Ohaus PL 150. (150 lb x .1 lb)

Step 1. Zero the scale with no load (no weights) on the platform. Turn off automatic-zero tracking. The center of zero indicator must be on, indicating that the scale is within .3 division from zero. (If automatic-zero tracking can not be turned off, conduct the test outside the range of auto zero by applying approximately 1 lb to the platform.) Place .14 lb of class F test weight on the center of the platform. If the indicator changes by at least 1 division, the scale is acceptable.

Step 2. Place a total of 75 lb of class F test weights on center of the upper left hand quarter of the scale platform. If the scale indicates 75 lb ±.2, the scale is acceptable. Repeat this test on the other three quarters of the scale platform. (Shift Test)

Step 3. Determine the capacity that the scale will be tested to:

The scale has a capacity of 150 pounds X .1 pound, but in this example the scale is only used to weigh products up to 100 pounds. Place test weights centered on the scale equal to half-capacity and full capacity (up to the used capacity - 100 lb), and record this weight on the test form. (Increasing Load Test)

Table 16 Increasing Load Test Error

Test Load	Indication	Error	Maintenance Tolerance	Acceptance Tolerance
50	50.1	.1	.1	.05
100	100.1	.1	.2	.1

Step 5. Remove the weights from the platform to decrease the load to one-half capacity (50 lb) and note the indication is 50 ± .1 lb. (Decreasing Load Test)

Step 6. Remove the weights from the platform and note the scale response with no load applied (zero balance shift test). The scale should indicate 0 ± .1 lb.

(7) Decreasing-Load Test

A decreasing-load test shall be conducted on automatic-indicating scales only. Test the scale with a test load equal to one-half of maximum-used capacity of the scale, centered on the load-receiving element of the scale.

(8) Dial Test

Test the dial at no less than four points on the reading face, including all possible quarters of the reading face capacity. Test all unit weights, if so equipped.

o. Testing and Calibration Procedure for Master Railway Track Scales

(1) Visual Inspection

(a) Inspect the scale deck for wear and check for binds between the weigh rail and the approach rail.

(b) Measure the gap between the weigh rail and the approach rail. If this distance is less than ⅛ inch or more than ⅜ inch, the owner must make adjustments prior to the test.

(c) Inspect the scale pit for cleanliness and dryness.

(d) Inspect all mechanical connections of the lever system. While performing this inspection, put the blade edge of a screw driver between lever and the side of the clevis at the pivot point, adjust so there is equal distance on both sides between the clevis and the lever.

(e) Inspect the weighbeam, poise, butt connections, and counterpoise tip loop connections. Use the same procedure as employed in the inspection of the lever system.

(2) Preliminary Setup

(a) Attach the flexible pointer that is found in the butt-ratio weight kit to the trig loop.

(b) Attach a ruled chart to the weighbeam as close as possible to the tip clevis assembly.

(c) Set up a magnifying glass so that while reading the turning points there will not be a parallax between the pointer and the graduated divisions on the ruled scale.

(d) Measure 6 inches from the left and right end of the scale rail on the weighbeam side and place a chalk mark at these 2 points on the outside of the rail.

(e) Divide that distance between the two marks into four parts and mark. Number all the marks l through 5 from left to right.

(3) Test Procedure

The method for determining error in the testing of a railway master scale is by applying weights to the test load and comparing those weights to the weight that was used on the scale rail at zero balance. The differences in these weight values are identified as plus or minus errors. However, on plate fulcrum master scale this method need not be used as the plate fulcrum scale has a vernier fractional bar attached to the weighbeam. This fractional bar is calibrated in 0.1 pound, therefore, by moving the poise to acquire the acceptable turning points for the beam and using the poise reading, true error can be determined without the use of error weights.

(a) Place a 10-pound weight on the weigh rail without any counterbalance weight on the tip dish. Adjust the balance ball until the beam swings equidistant above and below the center mark of the ruled scale. The number of divisions of swing above and below should not exceed twenty. (Dampen the beam swing by hand stroking it in the direction of the tip.)

(b) Enter test data on the "Master Scale Test Record" as indicated in Attachments 14 and 15.

(c) Remove the 10,000-pound weight dolly from the test weight car.

NOTE: Prior to moving the standards, examine all the bolts, connectors, chains, and hooks. Do not use any equipment that shows signs of wear or fatigue.

(d) Load two 10,000-pound weights on the dolly.

(e) Plug the electrical cable into the dolly.

(f) Place three 10-pound weights onto the tip dish at the end of the weighbeam.

(g) Remove the balance weights from the weigh rail and place them on the weight dolly.

(h) Activate the dolly electrical control handle until the dolly will move onto the scale.

(i) Stop the dolly so that the rear wheel is centered over the first chalk mark on the left end of the scale rail.

(j) Remove the electrical cable from the dolly.

(k) Unlock the weighbeam. Dampen the beam movement with your hand until the beam swings consistently up and down. The range of the swing in relation to the pointer and scale should be between 13 and 7 divisions. If the swing is too high or too low, remove or add trim or error weights from or to the dolly in one pound increments until the range is acquired. The amount of trim or error weight left on the dolly is recorded on the test record. Record the turning points of the beam from the weighbeam chart on the test record.

(l) Determine sensitivity by adding or removing error weights in one pound increments from the test load (dolly) and record the turning points and compute. Record the error or trim weight now on the dolly.

(m) Dampen the beam gently to the bottom of the trig loop and lock. Connect the electrical cable to the dolly and move to position number 2 (second chalk mark on the rail). Remove electrical cable from the dolly and repeat step k. Sensitivity is not taken at this position.

(n) Continue this procedure until all 5 test positions have been completed. Always locking the beam when moving to the next position.

(o) Remove the test load (dolly) from the scale. In most cases it should be removed from the right end. However, in some cases there is not enough clearance off the right end and the dolly must be reversed and removed from the left end.

(p) Remove the trim or error weights from the test load and remove the counterweights from the tip dish at the end of the weighbeam. Place the trim or error weights taken from the test load (dolly) and place them on the weigh rail and determine the balance change of the scale that occurred during the test. Use the same procedure to make the balance change determination as was used to determine zero balance.

(q) Place the three 10-pound counterpoise weights on the tip dish at the end of the weighbeam, remove the trim or error weights from the scale rail and place them on the weigh dolly.

(r) Repeat steps h through p in the opposite direction starting at position number 5 from the right end of the scale. However, in those cases where there is not enough clearance on the right end of the scale, the dolly must be moved onto the scale from the left end to position number 5. The testing positions are reversed with the sensitivity being taken at positions 2 and 4 until all 5 positions have been tested.

(s) When all positions have been tested, remove the dolly from the scale, unload the tip dish, remove the trim error weights from the test load (dolly), and determine balance change.

(t) Load seven more 10,000-pound weights from the test car onto the dolly. Place seven more 10-pound weights on the tip dish at the end of the weighbeam. There are now 100,000 pounds of test weights to load on the scale and 100 pounds of counterweight on the tip dish.

(u) This test run is conducted using the same testing sequence as was used at the 30,000-pound loading.

(v) The next step is to determine if the amount of error, which has been calculated and entered in column 26 (ERROR) of the test record, is within the tolerance prescribed for railway master scales listed below.

Table 17 Tolerances for Master Railway Track Scale Test

	TOLERANCE IN POUNDS	
LOAD IN POUNDS	**MAINTENANCE TEST**	**ADJUSTMENT TEST**
30,000	-------	3.7
40,000	8.4	4.2
50,000	-------	4.7
60,000	10.4	5.2
70,000	-------	5.6
80,000	12.0	6.0
90,000	-------	6.4
100,000	-------	6.7

(w) If the errors exceed these established tolerances and an adjustment is necessary, inform the owner of the scale of which test position or positions the scale exceeded tolerance and have the owner adjust the scale.

(x) After the adjustments have been made, the 30,000 and 100,000-pound test loads must be applied to the scale again using the same test procedure.

(y) When the results of the test data from the 30,000 and 100,000-pound loadings indicate the scale meets the tolerance requirements at those loads, the remainder of the test loads may be applied to the scale using the same testing sequence and procedure.

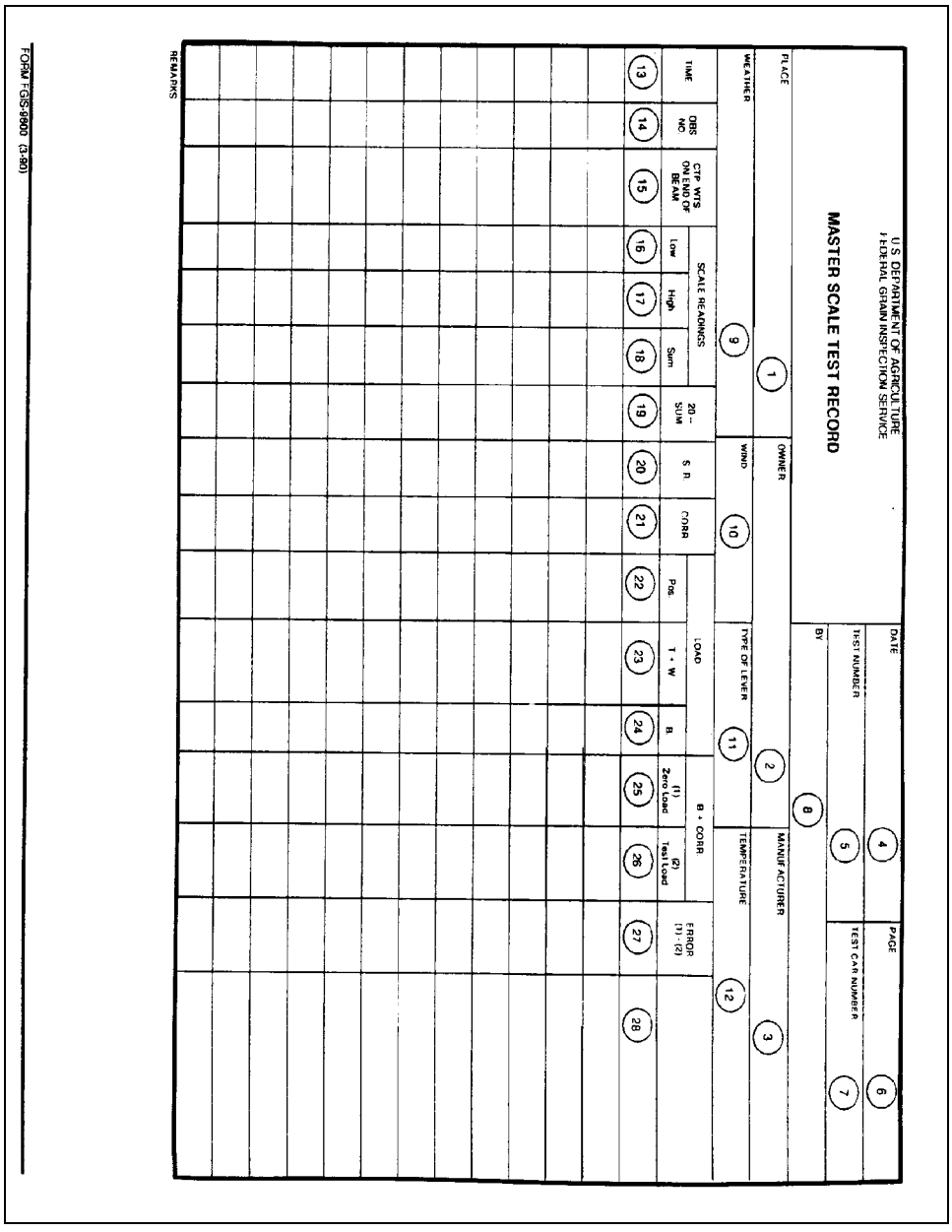
(z) Distribute the "Master Scale Test Record" as follows.

1) White copy to the Weighing and Equipment Branch, FM, Washington, D.C.

2) Pink copy to the owner to be retained at the master scale site.

3) Second pink copy to the State Weights and Measures authority in which the scale is located.

Master Scale Test Record



ATTACHMENT 15
WEIGHING HANDBOOK
CHAPTER 3
3.5 TEST PROCEDURES
9/20/96

Instructions for Completing Master Scale Test Record

1 Place. The city and state of the scale's location.

2 Owner. Indicate the owner of the scale.

3 Manufacturer. The name of the company who manufactured the scale.

4 Date. The month, day, and year of the test.

5 Test No. Enter the preassigned test number.

6 Page. Enter the page number.

7 Test Car Number. Enter the number of the FGIS test car.

8 By. Enter the initials of the person or persons testing the scale.

9 Weather. Enter the weather condition outside the building ; i.e., warm, cold, snow, rain, etc.

10 Wind. Enter wind condition and direction.

11. Type of Lever. Enter "G" , strait lever, or "S", plate fulcrum.

12 Temperature. Enter the temperature at the scale.

13 Time. Enter the time.

14 Obs. No. Enter the observation number.

15 CTP Wts. on End of Beam. Enter the weight value on counterpoise tip hanger on the end of the beam.

16 Low. Enter the low reading of the beam swing according to the pointer scale division relationship.

17 High. Enter the high reading of the beam swing according to the pointer scale division relationship.

If the readings entered in columns 15 and 16 are the first reading after the beam has been released and dampened, a line must be drawn under so as to designate it as the
first reading.

18 Sum. Enter the sum of the readings. Average the two low or high readings and add to the one remaining reading that is left after you have "thrown out" the first reading that was underlined.

19 20 - Sum. Enter the divisional difference of the number in column 16 and the number 20.

20 S.R. Enter the Sensitivity Reciprocal in pounds. To determine the S.R. subtract the small number from the large number in the sum column l7 and enter that number in column 27 and divide that number into l.0 pound. The results will produce the S.R. for a l-pound change on the weigh rail.

Example:
Obs l sum col. l9.0 div = l0 lb on rail or load
Obs 2 sum col. 23.6 div = ll lb on rail or load
Difference 4.6 div = l lb
l lb: 4.6 div = .22 lb
l div = .22 S.R. in column l9.

S.R. will be taken at positions l, 3, and 5 at all odd number runs and position 2 and 4 at all even runs.

21 Corr. Enter the correction. To determine correction, multiply the number in column l8 by the number in column l9. This product is the correction. Assign column l9 ± value the same as column l8.

22 Pos. Enter the position that the weight dolly is positioned on the scale rail l thru 5. If you are checking zero with the dolly off the scale, enter 0 in this column.

23 T + W. Enter the value of the test load on the scale 30,000 through l00,000 pounds. If checking balance with no load, enter 0 in this column.

24 B. Enter the value of the trim or error weights that are being used to determine the balance condition of the scale on the weights that are added to the test load to bring the sum of the turning points to as close to zero as possible.

25 Zero Load. Enter the amount of weight in column 23 plus the correction as recorded in column 2.

26 Test Load. Enter the value of the trim or error weight in column 23 plus or minus the correction in column 20.

27 Error. Enter the difference of the entries in column 25 and mean of the two entries in column 24. To calculate the value of zero load in column 24, use the weight value, ± correction that produced the turning points to the sum nearest to 20 when determining the zero balance of the scale. Then use the same method of selection when completing the run. The mean will be the average of the top and bottom entries in column 24. Place that mean midway between the
two and use the word "mean" over the entry.

28 Column 27 is used to compute S.R. Use the divisional change for a 1-pound weight being placed on or taken off the scale rail or the test load.